ELECTRO-THERAPEUTICS

[First Paper]

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When the school board of London was debating whether elementary instruction in science should be given in the schools under its control, it was objected that the scholars would get only a smattering. "Who has more?" asked Sir John Lubbock in reply, "those who are the most advanced in knowledge will be the first to admit how slight that knowledge is." Now a nurse will be occasionally required to apply a course of electrical treatment, and she may be nervous, as she does not know what electricity is. She may be comforted, as no one knows what electricity really is, we simply know how to produce it by certain methods: friction, chemical process, heat and mechanical energy—and when obtained, how to harness its force and convert its power into furnishing wireless telegraphy, electric light, medical batteries and many other conveniences that we see around us.

Many writers on electro-therapy delight in the use of literary terms to explain phenomena which are simply indescribable, because not fully understood. We shall try to eliminate such decorative non-essentials so that we may obtain a clearer understanding of the simple and easily understood fundamentals which underlie and govern electrical manifestations.

There are two methods of producing an electrical current, (1) by chemical means, as in a cell, and (2) by electro-magnetic induction as in the dynamo.

A simple form of cell may be made as follows, a strip of zinc and a strip of copper are placed vertically in a glass tumbler without touching each other. The tumbler is then nearly filled with a weak solution of sulphuric acid, and the two metal strips are connected with copper wire. A current of electricity will flow through the wire from the copper to the zinc. As already stated we do not know just what electricity really is, but we do know that by following the above process, and making certain chemical and mechanical combinations, we can produce as much electricity as we require. One of the metals was acted upon chemically by the liquid (electrolysis) which then caused a difference of pressure (potential) between the metals, causing a current

to flow through the circuit from the copper to the zinc. The copper is called the positive (+) pole, and the zinc the negative (−) pole.

The essentials of a cell are:

1. A liquid capable of electrolytic (decomposing) conduction, as dilute sulphuric acid, sal-ammoniac solution, etc.

2. Two metal plates submerged in the liquid and not in contact with each other below the surface, as zinc and copper, or zinc and carbon.

The metals are called the elements, and to these are connected the wires which lead from the cells to the instruments to be worked by the current.

Since the perfection of the dry cell, wet cells are rarely used for office machines, and never for portable outfits.

Now that we have produced our electrical current, in order to apply it scientifically, we must employ certain expressions to convey certain meanings. When a physician prescribes the use of a drug, he tells the nurse to give one ounce, one drachm, or five minims, or whatever quantity he desires the patient to have, knowing that by the use of graduated measuring glasses she will be able to give the exact quantity prescribed. When ordering sugar, tea or coffee from the grocer we order so many pounds or ounces, and if we purchase dress material, we order so many yards of a certain width. All this is very simple, because certain expressions of measurement have been employed. Now the first measurements in electricity are the volt, the ampere and ohm, which we will explain in their order.

Volt. The flow of electricity through a wire is sometimes compared to the flow of water through a pipe. Suppose we have a tank, containing one hundred gallons of water, placed on the roof of a house, with a pipe leading from it to the ground. Suppose, further, that at the end the pipe is bent a few inches upward. If the tap is opened, the water will spout upward from the end of the pipe with great force, on account of the weight or pressure of the water in the tank. This weight, energy, pressure or potential is measured in pounds, and therefore a pound is the unit of pressure or force of water. In electricity, the same force, the unit of pressure, tension, energy, or electro-motive force, is called a volt.

Ampere. If the water were being discharged from the tank through the pipe at a gallon per minute, this would be the rate of flow, that is, a certain quantity will pass out of the pipe in a certain time. In electricity, the volts of pressure act so as to force the quantity of current to flow through the wires at a certain rate per second, and the rate or volume at which it flows is measured in amperes.

Ohm. We know that a pipe can only, at a given pressure, admit so much water through it at a time, therefore the pipe presents a certain amount of resistance to the passage of the total quantity of water from the tank, we also know that water has substance and weight, and therefore occupies space, but electricity has neither substance nor weight, and therefore cannot occupy any space; consequently, to carry electricity from one place to another we do not need to use a hollow pipe, we use a solid wire, and these solid wires have a certain amount of resistance to the passage of the electricity, just as the water pipe has to the water, and the wire resistance is measured per foot, according to the metal used, and the size of the wire, that is to say, the finer the wire the greater number of ohms of resistance it has to the foot.

Insulation. The water cannot escape from the pipe so long as there are no holes or leaks in it. Just as the iron of the pipe prevents the water from escaping, the insulation of the wire prevents the escape of electricity. Insulation consists in covering the wire with rubber or other suitable non-conductor.

Opposition. There is another term which should be used in connection with electrical measurements, and that is opposition. Let us give an example of what opposition would mean when applied to water.

Probably every one knows that a water mill-wheel is a wheel having large blades, or paddles around its circumference. When the water in the stream in trying to force its passage, rushes against one of these paddles it meets with its opposition, but overcomes it by pushing the paddles away. This brings around more opposition in the shape of another paddle, which the water also pushes away, and so this goes on, the water overcoming the opposition and turning the wheel around, by which means we can get the water to do much useful work inside the mill. We must remember, however, that it is only by putting opposition in the path of the pressure of a quantity of water that we can get this work.

Most of us know that if you were holding a rope tightly in your hands and some one pulled it through them quickly and suddenly, it would get very hot and your hands would feel as though they were being burned. This is heat caused by your hands resisting or opposing the passage of the rope through them, and if you should hold on tightly enough and the rope were drawn through quickly enough, it would take fire. This fire would therefore cause heat and light.

The same principle holds good in electricity, we produce electricity in various ways, and in order to obtain useful work, we put in its path the instruments, lamps or machines which offer the proper amount of

resistance or opposition to its passage, and thus obtain from this wonderful agent the work we desire it to accomplish.

In our cities and large towns, the electric-light plant supplies a direct or an alternating current of about 110 volts. This pressure or electro-motive force would be the same whether one lamp or ten thousand were lighted, but as each incandescent lamp requires about three-quarters of an ampere to make it give a light of 16-candle power, there must be sufficient volume (amperage) in the wires to give each lamp its proper quantity. If there are 50,000 lights, there must be an amperage of 37,000. This current is entirely too great for ordinary electro-therapeutical work, therefore we use rheostats or current controllers to lessen the quantity flowing from a given point to a patient. A rheostat permits minute graduations, and an increase or decrease of current strength without shock.

When a street current is not available, we use cells, and as the average dry or wet cell delivers a current of only 1½ volts, with an amperage of about 25, we must use a number of them in order to obtain enough current for practical work.

When a current of 7½ volts is needed, we simply connect five cells in series, attaching the carbon of one cell to the zinc of the next, and so on, we would then attach a wire to the carbon of the first and one to the zinc of the fifth cell (fig. 1) and there would be 7½ volts pressure in

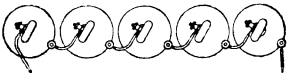

Fig. 1

the two wires. Now if each of the cells gave 25 amperes alone, the five will only give 25 amperes together when they are connected in series. This is called connecting in series for intensity.

If we wanted to increase the volume (or amperage) we would connect the carbon of the first to the carbon of the second, and so on, until all the carbons were connected with each other; then we connect the zinc of the first with the zinc of the second, and so on, until all the zincs were connected. We then attach a wire to the zinc in the first cell, and one to the carbon in the fifth cell, and we then obtain from these two wires only 1½ volts, but 125 amperes. This is connecting in series for quantity.

Now we know how to procure electricity, and we can enter the sanctuaries of the elect and patter about volts and ohms and high and low tensions, amperages, etc., but it may be wise to learn in what

manner, since electricity has no substance, and therefore cannot occupy space, we can manage to grab this elusive agent that we cannot see, and in addition change its form of energy to provide the different therapeutical effects which different diseased conditions demand.

Our next paper will discuss magnetism, the induction coil, and the galvanic, faradic and sinusoidal currents of electricity.

PROPER SLEEP FOR NURSES

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Because the matter of gaining sufficient sleep when on night duty is a serious thing to many a nurse, we want to give a few suggestions on mind control[1] to the young nurse about to begin her career as a professional woman; for we believe that much wakefulness may be avoided and sleep naturally induced if nurses will begin in the early days of their training, to acquire control of their mind and control of their thoughts, when settling for sleep.

The rule for sleep is simple to tell and easy to remember. "Relax, put every kind of a thought out of your mind, make it an absolute blank and keep it a blank, and sleep will follow."

This requires a peculiar concentration, of a kind somewhat difficult to acquire, However, it is well worth practicing, until we are such masters of our minds, that we may go to sleep at will, provided there are not outside disturbances in the way of unreasonable noises. The practice may seem difficult at first, but exercise patience with yourself and make perseverance your watch-word.

When you discover that a train of thought has crept all uninvited into your mind, thereby destroying the kind of concentration for which you are striving, put it out and shut it out. Relax, picture to yourself an absolutely blank space and start in again to concentrate on that empty space. Every time you discover that a thought has crept into that space, tell yourself that you are not properly concentrating, are not exercising sufficient control. And remember, mind control and concentration, if not possessed, are valuable assets to acquire. You need their help in study, in lectures, in the careful heed to your doctor's orders, in the care of your patient, and last, though not least, you need them in helping you to gain sleep.

[1] For her ideas on thought control, as a means of inducing sleep, the writer is indebted to suggestions given several years ago in a magazine devoted to ideas on mind power.